<u>REMARKS/ARGUMENTS</u>

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-4 and 6-28 are pending in the present application. Claims 1, 21, 24, 25, and 28 are amended, and support for the amendments is found in previously presented Claims 21, 24, 25, and 28 as well as Figure 8 of the specification. It is respectfully submitted that no new matter is added by this amendment.

In the outstanding Office Action, Claim 28 is objected to; Claims 21 and 23-25 are rejected under 35 U.S.C. §112, second paragraph, as indefinite; Claims 1-4, 6, 7, 9-15, and 21 are rejected under 35 U.S.C. §102(e) as anticipated by <u>Saitoh et al.</u> (U.S. Patent 6,693,338, hereinafter "<u>Saitoh</u>"); Claims 8, 16-20, and 28 are objected to as dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims; and Claims 22, 26, and 27 are allowed.

Applicants acknowledge with appreciation the early indication of allowable subject matter in Claims 8, 16-20, and 28, and the early indication that Claims 22, 26, and 27 are allowed. However, since the Applicants believe amended independent Claim 1 and amended independent Claim 21 patentably distinguish over the cited references of record, dependent Claims 8, 16-20, and 28 have been maintained in dependent form.

Claim 28 is amended to depend from Claim 23 placing Claim 28 in proper dependent form. Therefore, it is respectfully requested that the objection to Claim 28 be withdrawn.

Claims 21, 24, and 25 are amended to clarify the language resulting in the 35 U.S.C. §112, second paragraph, stated on page 2, paragraph 3 of the outstanding Office Action. More specifically, Claim 21 is amended to recite "at least two third semiconductor layers" and delete the language "every border regions." Claims 24 and 25 are amended to be

consistent with Claim 21 from which they depend. In light of the above amendment clarifying the language of Claim 21, it is respectfully requested that the rejection to Claims 21 and 23-25 under 35 U.S.C. §112, second paragraph, be withdrawn.

Briefly recapitulating, the power semiconductor device in amended Claim 1 includes a first semiconductor layer and second semiconductor layer of the same conductivity type, "wherein an impurity concentration of the first semiconductor layer is lower than that of the second semiconductor layer; and a layer thickness ratio A is given by an expression:

$$0 < A = t / (t+d) \leqq 0.72,$$

where t is a thickness of the first semiconductor layer, and d is a thickness of the second semiconductor layer." Further, assuming that a breakdown voltage of the power semiconductor device in amended Claim 1 "is represented by VB (V), then t, VB (V), and A satisfy a relationship below:

$$t < 2.53 \times 10^{-6} \times (A \times VB)^{7/6} \text{ (cm)."}$$

By setting the thickness t of the first semiconductor layer according to the above relationship, the power semiconductor device attains an on-resistance lower than a conventional superjunction device as shown in Prior Art Figure 15 of the Applicants' specification. Further, amended Claim 1 recites that "the first to fifth semiconductor layers are constituted by a silicon layer." Claim 21 recites similar features as amended Claim 1 in addition to insulating films that are "interposed between the second semiconductor layer and third semiconductor layers."

Saitoh discloses a power semiconductor device with a first semiconductor layer and second semiconductor layer of the same conductivity type. However, Saitoh does not disclose a power semiconductor device, wherein assuming that a breakdown voltage is represented by VB (V), then t, VB (V), and A satisfy the relationship $t < 2.53 \times 10^{-6} \times (A \times$

$VB)^{7/6}$ (cm). The Office Action mailed November 30, 2004 on page 4, lines 13-22 states the

following.

> For example, t (first semiconductor layer 11) can be selected to be 15
> microns, and d (second semiconductor layer, 19) can be 7 microns, which
> would result in a ratio of 0.68. The ratio would be within the desired ratio
> discussed in lines 2-7 of column 8, and shown graphically in Figure 3a. The
> range of thicknesses that would result in a functioning device, while
> maintaining the desired range, is considered to be disclosed inherently by
> Saitoh et al., just as it is considered to be disclosed in the instant application,
> which does not explicitly disclose all possible combinations of thicknesses.
> The proposed values would result in the expression $t < 2.53 \times 10^{-6} \times (A \times VB)^{7/6}$ (cm) being equal to about 28.2, which is greater than the thickness t, of
> 15 microns.

Similar to the Office Action mailed November 30, 2004, the Advisory Action mailed March

17, 2005 in response to an Amendment after Final filed on February 28, 2005 that was not

entered by the Examiner, reiterates that "t" can be selected to be 15 microns and that "d" can

be 7 microns. However, the Applicants respectfully submit that these values are not

disclosed by the Saitoh reference. Further, the Advisory Action indicates these values satisfy

the relation: $0 < A = t / (t+d) \leq 0.72$. The Applicants respectfully submit that it is

unreasonable to reject Claim 1 on the basis of such arbitrary values, and the values of "t," "d"

and "VB," disclosed by the Saitoh reference do not satisfy the conditions recited in amended

Claim 1.

The device disclosed by Saitoh is designed as a 600 Volt device. If the thicknesses t

and d are selected as 15 microns and 7 microns, the device cannot operate as a 600 Volt

device. If these thicknesses are selected, the device will be operable only as a 400 Volt or

less device. When VB = 400 Volts is input into the expression $t < 2.53 \times 10^{-6} \times (A \times VB)^{7/6}$,

$t < 17.5$ microns is obtained. Therefore, the expression recited in amended Claim 1 is not

disclosed by Saitoh.

When appropriate parameters are used, it is apparent that the present invention recited in amended Claim 1 is not anticipated by Saitoh as evidenced by the design examples in Saitoh. In one example of Saitoh, the breakdown voltage is 600 Volts, a thickness t of the first semiconductor layer is 39 μm, and a thickness t of the second semiconductor layer is 10 μm.[1] Applying these values to the relationship in amended Claim 1 results in A equal to 0.796, which is not less than 0.72, and therefore, does not satisfy the condition for A in amended Claim 1. Further, when A equal to 0.796 and a breakdown voltage VB equal to 600 Volts is applied to the relationship of amended Claim 1, the obtained value is 33.8 μm which is smaller than the thickness t equal to 39 μm as listed in Saitoh. Therefore the relationship t $< 2.53 \times 10^{-6} \times (A \times VB)^{7/6}$ is not satisfied.

A second example in Saitoh provides t equal to 13 μm and d equal to 30 μm.[2] In this example, a thickness ratio A equal to 0.302 is obtained. When these numbers as well as VB equal to 600V are applied to the expressions of amended Claim 1 the result is t < 10.9 μm. However, t is given in the example as 13 μm . Therefore, the expression, t $< 2.53 \times 10^{-6} \times (A \times VB)^{7/6}$, is not satisfied. There is also a third example explained in Saitoh, with t equal to 26 μm and d equal to 20 μm. According to the present invention, the value t = 26 μm is also out of the range defined by the expression given in amended Claim 1, and therefore these values also fail to satisfy the expression in amended Claim 1.

Accordingly, it is respectfully submitted that Saitoh does not disclose or satisfy the expression, t $< 2.53 \times 10^{-6} \times (A \times VB)^{7/6}$, recited in amended Claim 1. Further, it is respectfully submitted that Saitoh fails to disclose that "the first to fifth semiconductor layers are constituted by a silicon layer," as recited in amended Claim 1. Therefore, Saitoh does not teach each and every element of amended Claim 1, and it is respectfully requested that the

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[1] Saitoh, column 11, lines 20-23.
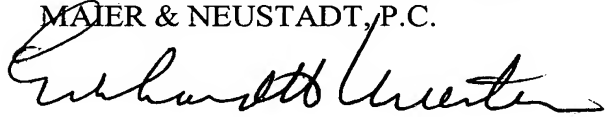[2] Saitoh, column 11, lines 28-29.

rejection to Claim 1 under 35 U.S.C. §102(e) be withdrawn. Likewise, it is respectfully

submitted that Claims 2-4 and 6-20, which depend from Claim 1, are allowable for at least

the same reasons as discussed above with respect to Claim 1.

Further, amended Claim 21 is directed towards a power semiconductor device,

"wherein insulating films are interposed between the second semiconductor layer and third

semiconductor layers," as shown in non-limiting example of Figure 8. Saitoh discloses

insulating films 22 in Figure 8, but does not disclose insulating films interposed "between the

second semiconductor layer and third semiconductor layers," as recited in amended Claim 21.

Therefore, it is respectfully submitted that Saitoh also does not teach each and every element

of amended Claim 21, and it is respectfully requested that the rejection to Claim 21 under 35

U.S.C. §102(e) be withdrawn. Likewise, Claims 23-25 which depend from amended Claim

21 are believed to be patentably distinguishable over Saitoh for at least the same reasons as

discussed above with respect to amended Claim 21.

Consequently, in view of the present amendment and in light of the above discussion,

the application as amended herewith is believed to be in condition for formal allowance. An

early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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